and its tadpole should be shown; a bird and its egg, and a cat or dog, and they should compare the limbs and other parts of a quadruped with their own arms, hands, legs and feet. A lesson once a week through each year of grammar-school life could be well taken from the time given to geography, in which the pupil is forced to learn, besides what is valuable and necessary, a mass of useless information, two years being given to the study of a single book. We are convinced that geography, as usually taught, is a sham and a delusion, the books contain a great deal of useless stuff, and at least a quarter of the time devoted to the study might be given to natural history.

Having thus had at least a weekly lesson in zoölogy in the three years of grammar-school life, and having learned the different parts of a clam shell, and the parts of the animal, without dissection, and so on with the beetle, butterfly, fish, frog, bird and mammal, the pupil enters the high school. Here the boy or girl can, with the aid of a competent teacher, take a rather more advanced course with the same species of animal he has already had. The clam can be in part dissected; the lobster or crayfish and beetle, butterfly and higher animal can be partially dissected. In the case of a fish the student can, in connection with the study of physiology, dissect the animal and see for himself the heart, stomach, intestine and brain, and so with a chicken or bird of any sort. We have with much satisfaction taught a class of boys from a high school to dissect a lobster, and they enjoyed the work. By spending but a single hour a week, and confining the class to but few objects, they can obtain a fair idea of zoölogy, which will be a pleasure and involve a fair share of mental discipline, and have taken but little time from other studies.

A candidate for admission to college, and but few high school graduates go to college, should pass an examination involving a knowledge of but a few animal types, such as a clam, a lobster, a beetle, fish and bird; with this knowledge he can then appreciate an advanced course in general zoölogy, involving the laws of morphology, reproduction, embryology and zoö-geography, and by the senior year be able to digest the laws of the geological succession of animals, and of their evolution as well as of palæontology, for without a knowledge of these topics no young man has had a liberal education, and the young man who has not had such a course will be incompetent to teach biology in the common schools.

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RECENT LITERATURE.

NEWCOMB AND HOLDEN'S BRIEFER ASTRONOMY.[1]—Modern astronomy is now so closely allied in some of its methods, and

[1] *American Science Series, Briefer Course. Astronomy.* By SIMON NEWCOMB and EDWARD S. HOLDEN. New York, Holt & Co. 12mo, pp. 338.

touches in so many ways upon the science of geology, that a brief, compendious, general treatise like this, without the mathematics, is useful to the geologist. He will be interested in the chapters relating to the moon and particularly the tides and their effects upon the earth's rotation, since these subjects are now so much discussed by speculative geologists. So also the chapters on meteors, and especially the last chapter on cosmogony, including the statement of the nebular hypothesis, will be valuable as giving the opinions and conclusions of one of the leading astronomers of the day, while the concluding paragraph will be of interest as showing how the subject is treated:

"It must be understood that the nebular hypothesis, as we have explained it, is not a perfectly established scientific theory, but only a philosophical conclusion founded on the widest study of nature, and pointed to by many otherwise disconnected facts. The widest generalization associated with it is, that so far as we can see, the universe is not self-sustaining, but is a kind of organism which, like all other organisms we know of, must come to an end in consequence of those very laws of action which keep it going. It must have had a beginning within a certain number of years which we cannot yet calculate with certainty, but which cannot much exceed 20,000,000, and it must end in a chaos of cold, dead globes at a calculable time in the future, when the sun and stars shall have radiated away all their heat, unless it be re-created by the action of forces of which we at present know nothing."

NATURE STUDIES.[1]—This is a compact reprint of essays by some of the leading English popular-science writers which appeared in *Knowledge*. They are light, readable and timely papers, and vastly superior to much of the literature sold in bookstalls and railroad cars. As for being "studies," however, one may smile when we find Mr. Proctor who, we believe, started as an astronomer, writing, very pleasantly to be sure but perhaps not always authoritatively, on Darwin, Newton and Darwin, the Fiji islands, strange sea monsters, intelligence in animals, brain troubles and thought reading. The bare thought of one individual assuming the rôle of an expert and putting forth "studies" as only such an expert should, on such a concatenation of subjects, is enough to take one's breath away. The publishers, moreover, who do not seem to be over strong evolutionists, appear in a preface to mildly question whether some of the facts stated under the head of "found links" may not be "doubtful." We find, however, that what Professor Wilson writes upon is generally correct and very pleasantly written, though he is a compiler, and his sources are purely English. His readers are left almost entirely in the dark

[1] *Nature Studies*. By GRANT ALLEN, ANDREW WILSON, THOMAS FOSTER, EDWARD CLODD, and RICHARD A. PROCTOR. New York, Funk & Wagnalls. Standard Library No. 91. 12mo, pp. 252. 25 cents.